

(16)

exponent properties: $e^a e^b = e^{a+b}$ $\frac{e^a}{e^b} = e^{a-b}$ $\frac{d}{dx} e^u = e^u * u'$

Additional $y = \ln x$ and $y = e^x$ Properties: $e^{\ln x} = x$ | $\ln e^x = x$ | $\ln 1 = 0$ | $\ln e = 1$

Finding a Derivative In Exercises 33-54, find the derivative

33. $f(x) = e^{2x}$
 $f'(x) = e^{2x} \cdot 2 = \boxed{2e^{2x}}$

34. $y = e^{-8x}$
 $y' = e^{-8x} \cdot -8 = \boxed{-8e^{-8x}}$

35. $y = e^{\sqrt{x}}$
 $y = e^{x^{1/2}}$
 $y' = e^{x^{1/2}} \cdot \frac{1}{2} x^{-1/2}$
 $y' = \frac{e^{\sqrt{x}}}{2\sqrt{x}}$

36. $y = e^{-2x^3}$
 $y' = e^{-2x^3} \cdot -6x^2 = \boxed{-6x^2 e^{-2x^3}}$

39. $y = e^x \ln x$
 $y' = \frac{f'g + fg'}{e^x \cdot \ln x + e^x \cdot \frac{1}{x}}$
 $y' = e^x \ln x + \frac{e^x}{x}$
 *product rule

40. $y = x e^{4x}$
 *product rule
 $y' = 1 \cdot e^{4x} + x \cdot e^{4x} \cdot 4 = \boxed{e^{4x} + 4x e^{4x}}$

41. $y = x^3 e^x$
 *product rule
 $y' = 3x^2 \cdot e^x + x^3 \cdot e^x = \boxed{3x^2 e^x + x^3 e^x}$

42. $y = x^2 e^{-x}$
 *product rule
 $y' = 2x \cdot e^{-x} + x^2 \cdot e^{-x} \cdot (-1) = \boxed{2x e^{-x} - x^2 e^{-x}}$

43. $g(t) = (e^{-t} + e^t)^3$
 *chain rule:
 outside: $()^3$
 inside: $e^{-t} + e^t$
 $g'(t) = 3()^2 \cdot (e^{-t} + e^t)$
 $g'(t) = 3(e^{-t} + e^t)^2 (-e^{-t} + e^t)$

44. $g(t) = e^{-3/t^2}$
 $g'(t) = e^{-3t^{-2}} \cdot 6t^{-3} = \boxed{\frac{6e^{-3/t^2}}{t^3}}$

45. $y = \ln(1 + e^{2x})$
 $y' = \frac{u'}{u}$
 $y' = \frac{e^{2x} \cdot 2}{1 + e^{2x}} = \boxed{\frac{2e^{2x}}{1 + e^{2x}}}$

46. $y = \ln\left(\frac{1 + e^x}{1 - e^x}\right)$
 *expand first:
 $y = \ln(1 + e^x) - \ln(1 - e^x)$
 $y' = \frac{e^x}{1 + e^x} - \frac{-e^x}{1 - e^x} = \boxed{\frac{e^x}{1 + e^x} + \frac{e^x}{1 - e^x}}$